

These Are The 7 Things Keeping Women Out Of Science Careers – Student Handout

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Ada Lovelace Day, a day meant to honor female scientists as a way to remember Ada Lovelace, the first computer programmer, was Oct. 15.

In 1842, Lovelace wrote a computer program for a machine that didn't even exist yet.

More than 150 years later, women are still lacking in science fields. Nationally, women now earn close to 60% of bachelor's degrees overall, but only 20% of the degrees in computer science, 20% of those in physics, and 18% of those in engineering according to The New York Times.

Why women still aren't well or equally represented in the sciences (or, more specifically women in science, technology, engineering, and math — STEM) is a complex topic, and there's been a lot of talk about it of lately. Eileen Pollack wrote a wonderful New York Times Magazine piece on women in science, posted on Oct. 3.

We've broken apart some of the points she made and added some other sources to get a better grip on why there are so few women in science.

1. Teasing in school

Even at the high school level, teachers and classmates sometimes stereotype girls who are interested in advanced physics and math. Pollack spoke to Yale physics undergrads and heard these stories:

One young woman had been disconcerted to find herself one of only three girls in her AP physics course in high school, and even more so when the other two dropped out. Another student was the only girl in her AP physics class from the start. Her classmates teased her mercilessly: "You're a girl. Girls can't do physics." She expected the teacher to put an end to the teasing, but he didn't.

These kinds of reactions to their presence in these courses pushes young women out. Studies have shown that countries with greater gender equity had smaller gender gaps in math. When given the right support women do just as well as men — it isn't an inherent ability difference between the sexes.

"When girls see opportunities for themselves in science, technology, engineering and math, they're more likely to take higher math in high school and more likely to pursue those careers," researcher Janet Hyde, from the University of Wisconsin, said in a press release.

2. A Lack of Encouragement

Lovelace herself was encouraged to pursue math by her mother, to avoid the "dangerous poetic tendencies" of her father, the poet Lord Byron, according to The New York Times' Bits blog. This could be why she shed the female stereotype and pursued her STEM interests.

As Pollack, herself a physics major who didn't go into academia, writes: "I didn't go on in physics because not a single professor — not even the adviser who supervised my senior thesis — encouraged me to go to graduate school."

She graduated at the top of her class, but none of her professors even asked if she was going to graduate school.

Studies have shown that when told that men score better in math tests than women, women tend to score worse. When told that isn't true, the two genders scored equally well.

This might come from an "internal bias" in the minds of young female scientists, who may naturally under-rate their intelligence. Whether that's a cultural concoction or a difference in how female brain responds to encouragement, we don't know yet.

"Women need more positive reinforcement, and men need more negative reinforcement. Men wildly overestimate their learning abilities, their earning abilities. Women say, 'Oh, I'm not good, I won't earn much, whatever you want to give me is O.K.," Yale physicist Meg Urry told Pollack.

3. Stereotypes

Females playing STEM-literate characters are gaining more popularity in the movies — for example, Natalie Portman plays a physicist in the new "Thor" movie and Sandra Bullock stars in "Gravity" as a female Astronaut.

But, in other ways, women are being held back by stereotypes. In the hugely popular television show "The Big Bang Theory," female scientists are forced into "weirdo" roles, while the non-scientist is the only "normal" female character.

These stereotypes also extend into how we portray male scientists. Research has indicated that when females are exposed to nerdy white-guy stereotypes, it discourages them from STEM fields.

Studies have shown that when young women hear about a non-stereotypical computer scientist, their interest in the field increases.

4. Childcare

Even if young women make it through a bachelor's and enter academia, they often leave the STEM fields early in their career. A frequently suggested reason for this is the lack of maternity leave and childcare after having kids. This is also seen in the long-hour days of technology startups.

Tenure-track academics face steep obstacles in reaching their goals, and taking a "time-out" to have children is still a problem at many institutions. Astrophysicist and MacArthur "genius" grant award winner Sara Seager, of MIT, says she will use her \$625,000 award to pay for childcare to help her concentrate on her work. If this wasn't an issue facing academics, she wouldn't need to put her winnings toward it.

There are indications that having children isn't the main reason women leave STEM fields mid-career — after all, startups and academia allow flexible days and plenty of work from home opportunities — it does seem to become an issue for some research-minded women.

A study by Berkeley researchers found that 41% of women postdocs who had babies retreated from their original goal of being a research professor, versus 20% of single women.

5. Competition

Women are generally less competitive and aggressive than men, and this could impact their desires to follow through with a career in the sciences at the academic level — when constant competition to publish becomes the major determinant of a successful career.

The push to constantly compete can wear on someone whose personality isn't naturally inclined to be aggressive.

"While the women in our study were undoubtedly high achievers, many felt that the competitiveness of science (e.g., to secure a grant and post), and especially at the early career stages, results in less weight being given to integrity and meritocracy, making academia an unattractive long-term career option for those who are less naturally competitive," according to a study by the Wellcome Trust [PDF].

6. Marginalization

Even if women do find themselves a faculty position, they are frequently paid less than their male counterparts, given less lab and office space, get fewer awards for their work, and given access to fewer resources, an MIT committee found.

Women software developers earn 80% of what men do.

These figures hold true in larger studies, including one from the American Institute of Physics looking at 15,000 physicists in 130 countries. "In almost all cultures, the female scientists received less financing, lab space, office support and grants for equipment and travel, even after the researchers controlled for differences other than sex," Pollack wrote.

7. Bias

This marginalization is likely the result of bias. Women in the STEM fields face a constant bias against them, not just from male colleagues, but also from females.

For example, when presented with identical lab manager resumes from either a John or a Jennifer both male and female professors tended to pick the John as the better candidate, and offer him more money for the position.

As Johnathon Mohr points out on twitter, this bias is sometimes built into the "good old boy" network of tenured professors. If males are the majority of researchers that make it into the later stage of a research career, then they are making the decisions of who will get tenure, and hired for higher-level positions and awards.

This also crops up in male-driven Silicon Valley, where female entrepreneurs find getting funding hard to do because they aren't perceived as leaders, but as mothers. Women only start about 8% of venture-backed tech startups.

Hope ahead

It's not all bad news; more women are making it to college and graduate levels of STEM.

"If you look at the students scoring in the top one in 10,000 in mathematics in 1983, there were 13 boys for every girl," Steven Ceci of Cornell University, said in a press release. "Since then, until 2007, that gap has shrunk to somewhere between 2.8 and four boys for every girl."

A Berkeley study found that women represented between 20% (engineering) and 71% (psychology) of UC system Ph.D.s in science (51% of life sciences Ph.D.s).

There have even been stronger efforts to encourage women to go into sciences. "Marvel Ultimate Mentor Adventure," for example, is a new contest created by Marvel around the "Thor" movie premier to encourage girls to reach out to STEM mentors in their area and interview them. The girls get a trip to Hollywood for a movie screening, but also a week-long STEM adventure.

The problem comes when we want to keep these women in STEM careers, specifically academia, for longer. Many move out of research and hard-science fields and into more personable and "female" positions like health care or education. Improvements need to be made at the higher levels of STEM fields to keep women in these professions.